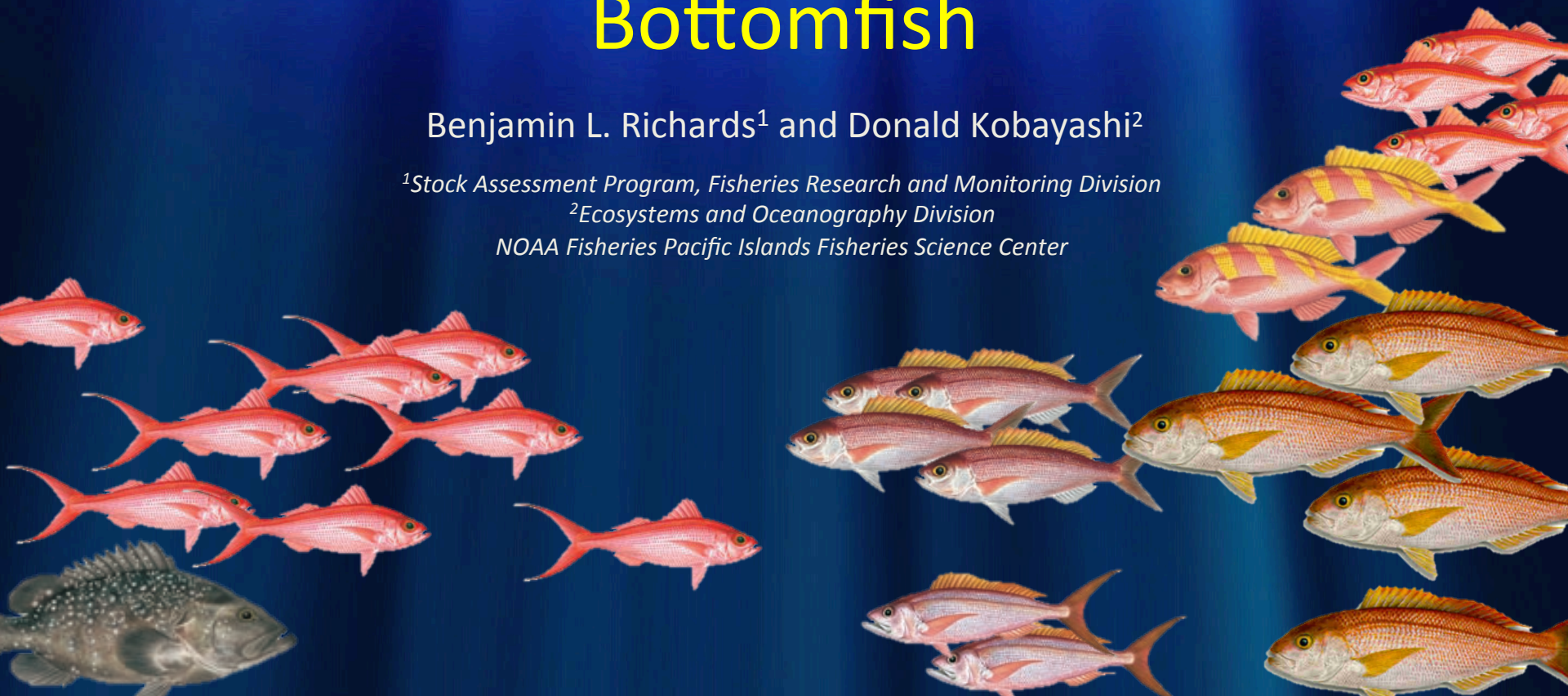
Pacific Islands Fisheries Science Center
NOAA National Marine Fisheries Service

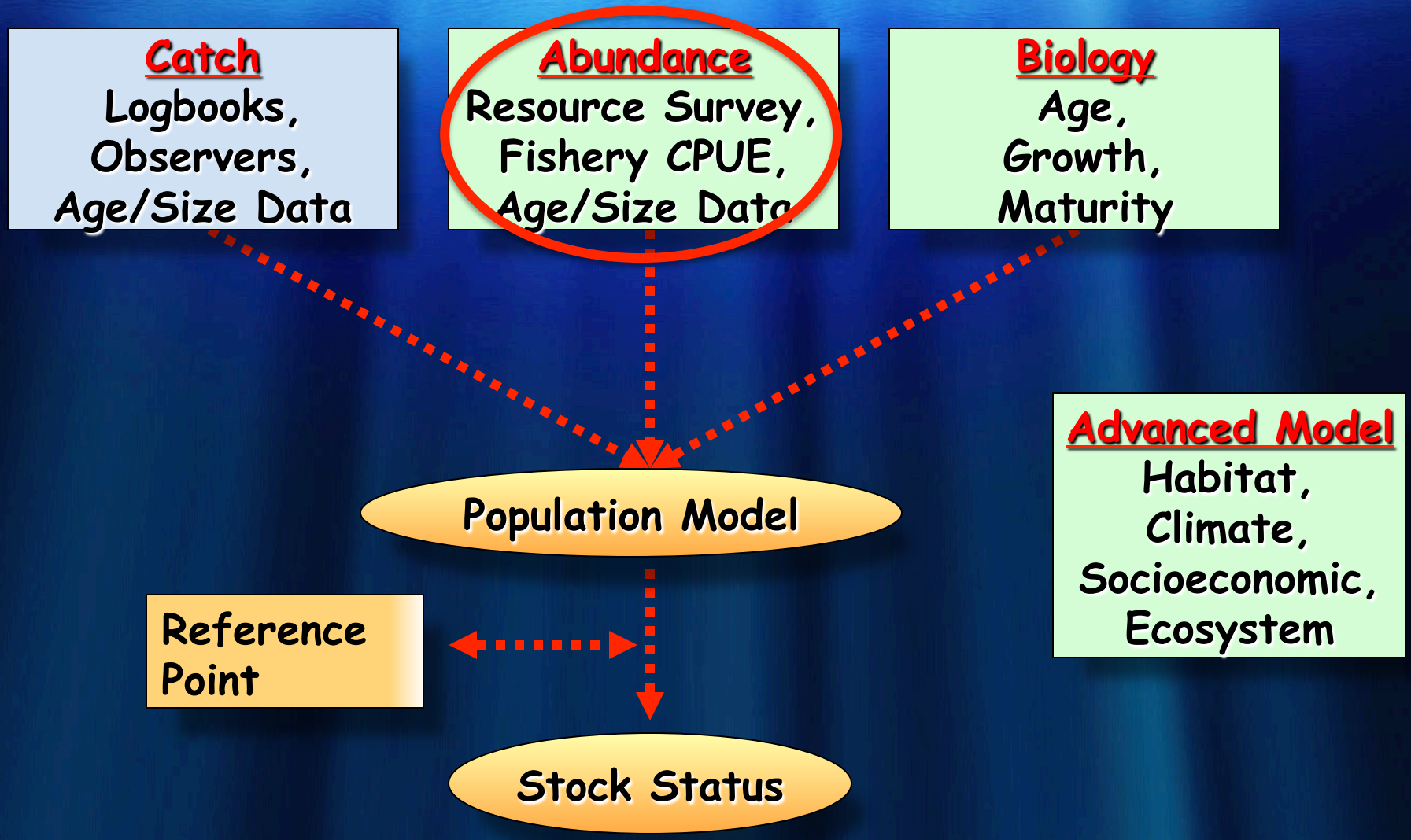
Comparison of Fishery-Independent Sampling Methods for Hawai‘i Bottomfish

Benjamin L. Richards[1] and Donald Kobayashi[2]

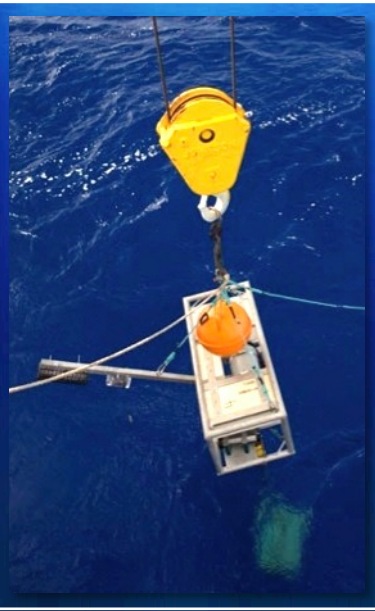
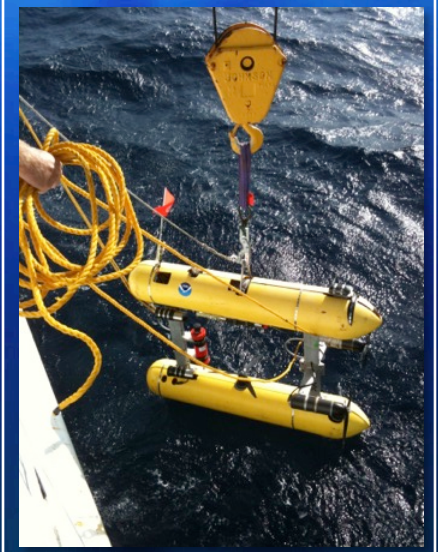
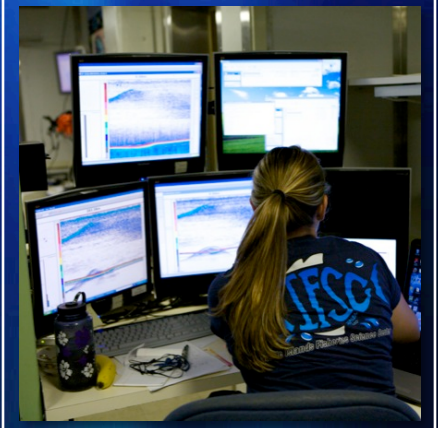
[1]Stock Assessment Program, Fisheries Research and Monitoring Division
[2]Ecosystems and Oceanography Division
NOAA Fisheries Pacific Islands Fisheries Science Center



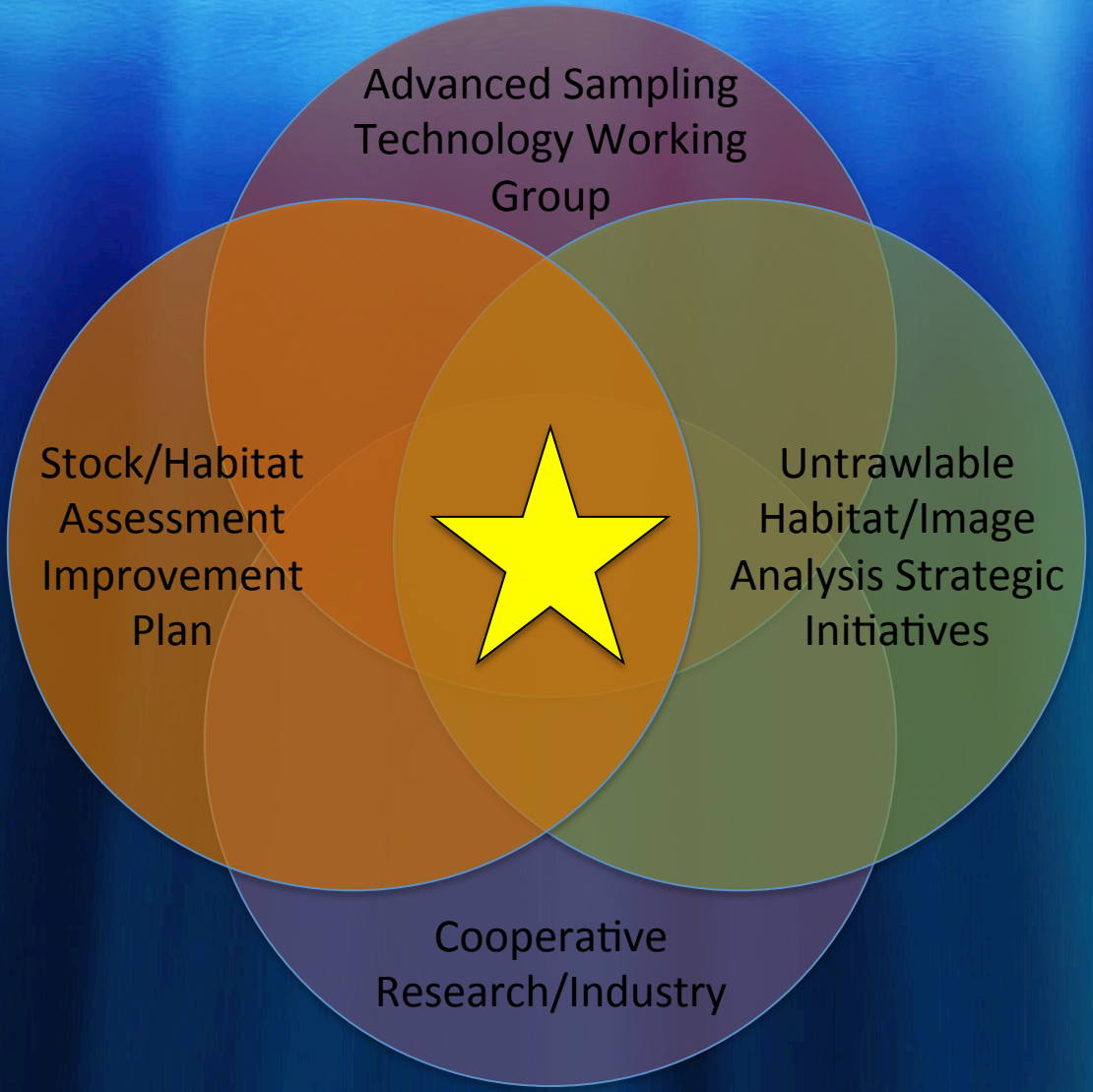
Stock Assessment Process



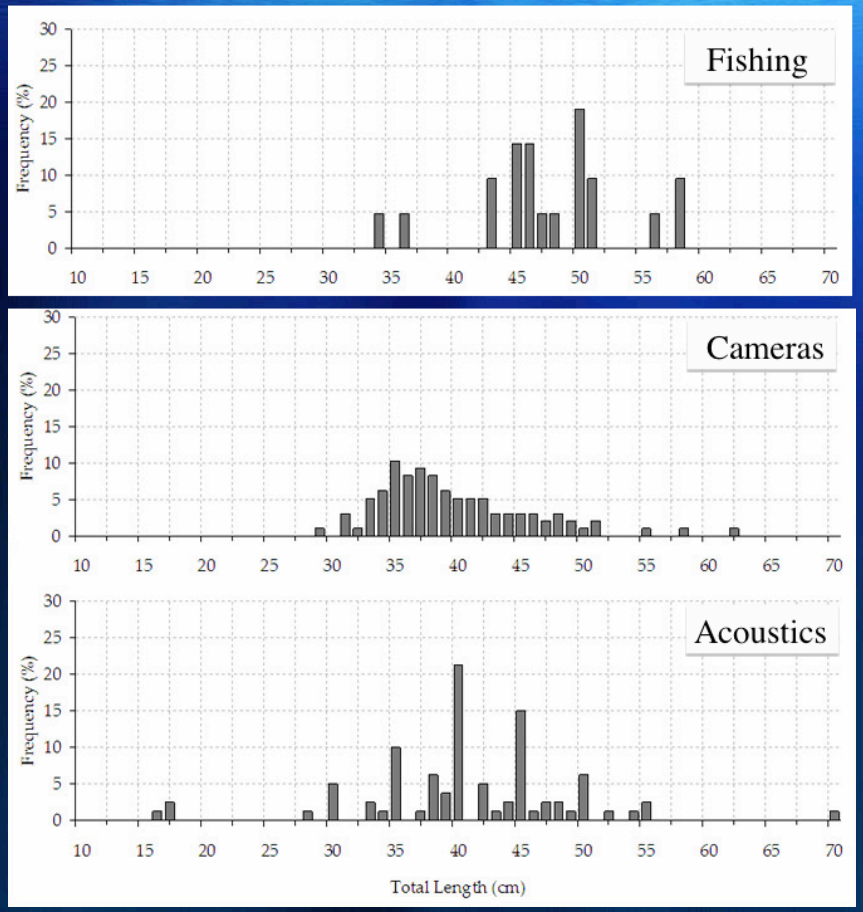
Fishery-Independent (Advanced) Sampling Technologies

Research Fishing	BotCam	SeaBed AUV	EK60
			
Hook/Line	Optical (Stereo Video)	Optical (Stereo Video)	Acoustic
Roving	Stationary	Roving	Roving
Baited	Baited/Un-Baited	Un-baited	Un-baited
20 min	15 - 45 min	2 hr	continuous

NOAA Fisheries Missions



Gear Comparison

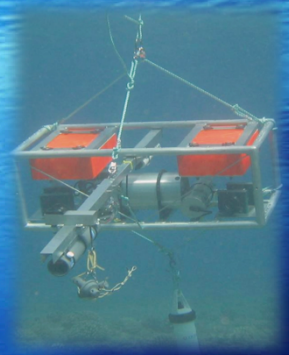


- Objective 1: Identify most efficient suite of fishery-independent gears
- Objective 2: Operational, multi-gear, fishery-independent bottomfish survey

Gear Comparison: Cooperative Research

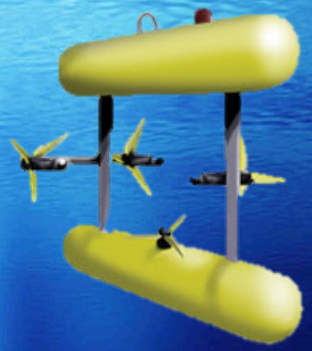
- Strengths
  - Good species/length
  - High sample number
  - Data processing time
  - Direct tie-in to fishery
  - Industry involvement / support
- Challenges
  - Selectivity
  - Standardization

BotCam



- Strengths
  - Excellent spp/length data
  - High sample number
  - Concurrent habitat data
- Challenges
  - Single depth
  - MaxN
    - Conservative
    - Biased lengths?
  - Data processing time
  - Attraction/Avoidance

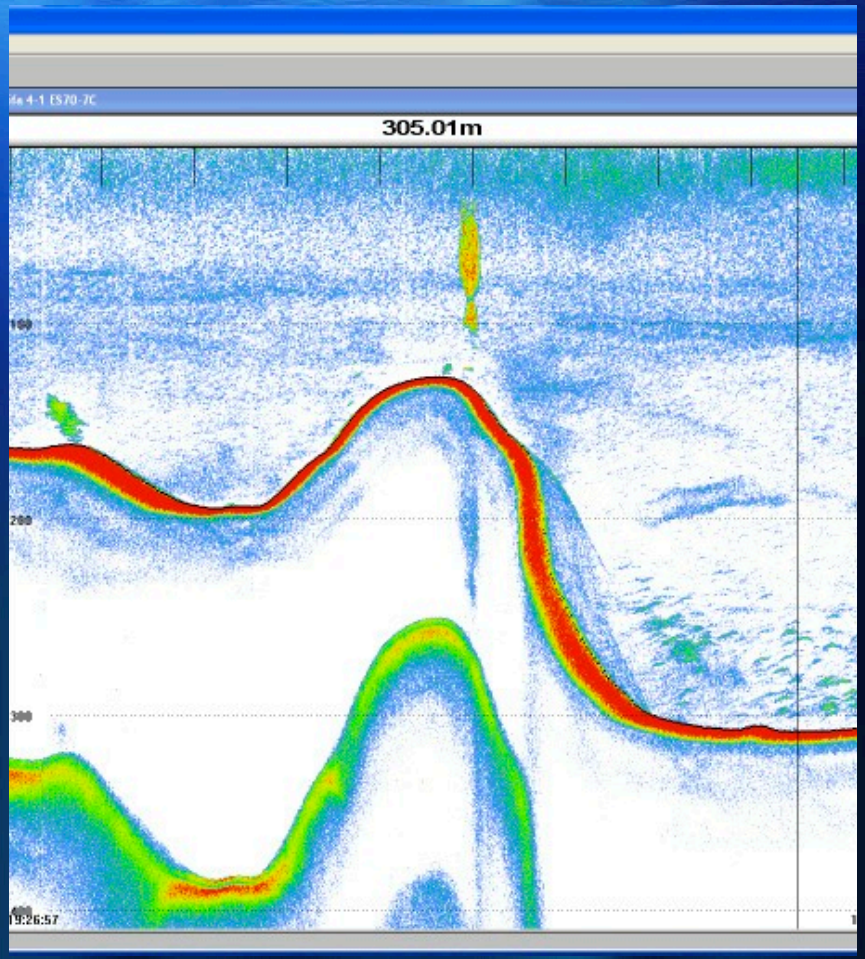
SeaBed



- Strengths
  - Excellent spp/length data
  - Concurrent habitat data
  - Ability to cover gradients
- Challenges
  - High equipment cost
  - Low sample number
  - Data processing time
  - Attraction/Avoidance

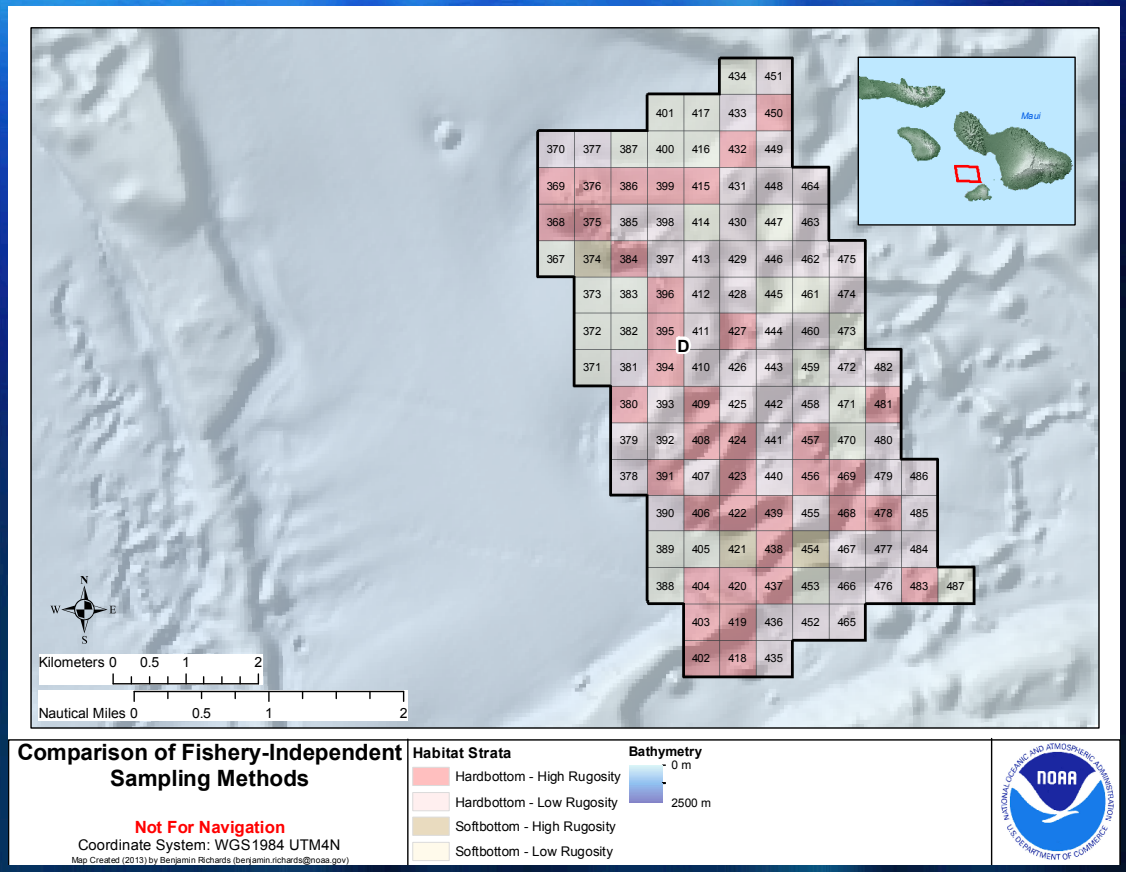
Acoustics

- Strengths
  - Large spatial coverage
  - Full water column
- Challenges
  - Difficulty of species ID
  - Less accurate length data
  - Dead zone
  - Data processing time



Sampling Domain

- Maui Triangle
- Stratification
  - Hardness
    - Hard
    - Soft
  - Slope
    - High
    - Low
  - Depth
    - 100-200 m
    - 200-300 m
    - 300-400 m



Completed Surveys

Year	Cruise ID	Survey Period	Region	Gears	n
2011	SE1102	2/25 – 3/8	Main Hawaiian Islands	PIFG Cooperative Fishing BotCam EK60 Active Acoustics	70 84 108
2011	SE1107	9/18 – 9/27	Main Hawaiian Islands	BotCam SeaBED AUV EK60 Active Acoustics	79 70 84
2012	SE1208	9/22 – 10/1	Main Hawaiian Islands	PIFG Cooperative Research BotCam EK60 Active Acoustics	146 89 60
2013	SE1302	4/18 – 4/30	Main Hawaiian Islands	PIFG Cooperative Research BotCam SeaBED AUV EK60 Active Acoustics	151 144 10 30

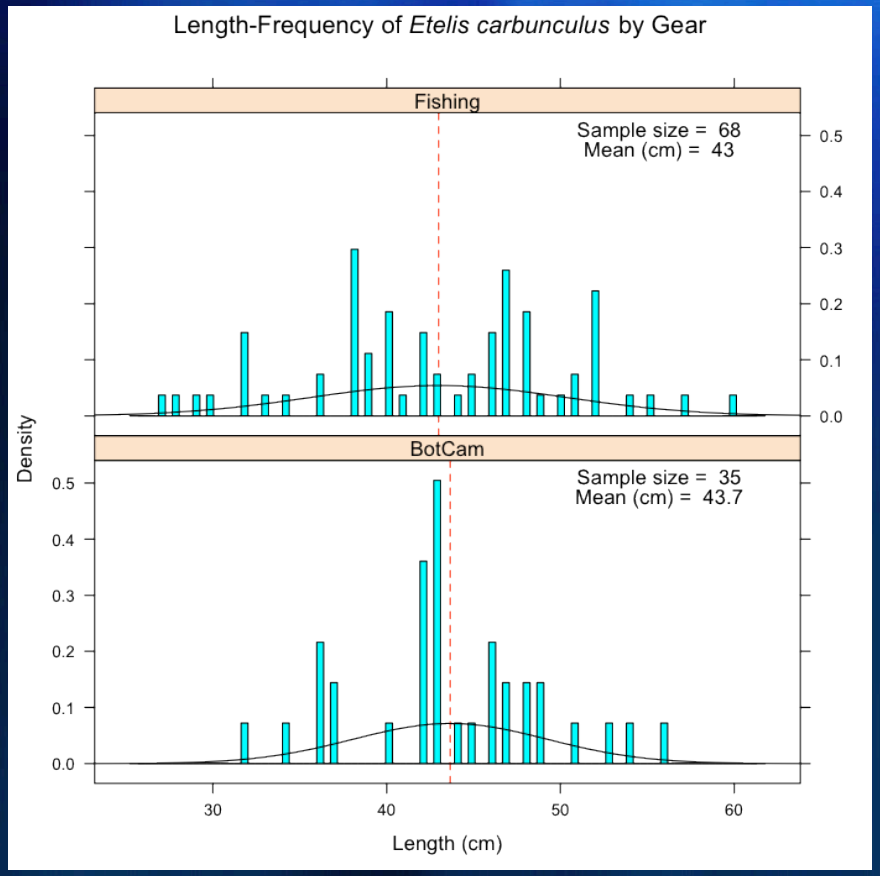
Preliminary Results

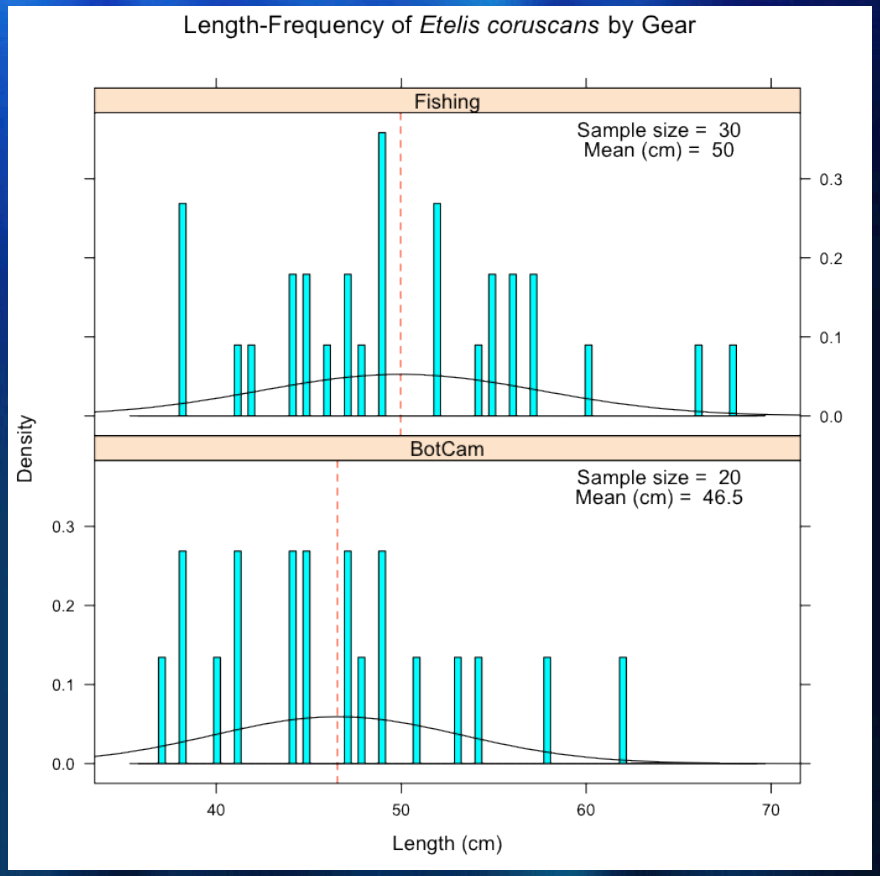
Number and percent of individual fish observed by Research Fishing and BotCam according to three species groupings: HI-Deep7, Other Bottomfish (e.g. *Seriola dumerili*), and Other Fish. Data for Research fishing is from SE1102 and SE1208. Data for BotCam is from SE1102, SE1107, and SE1208.

	Fishing		BotCam	
	#	%	#	%
Hawai‘i Deep-7	231	75%	385	56%
Other Bottomfish	9	6%	182	26%
Other Fish	59	19%	125	18%
Total	*309*		*692*	

Preliminary Results

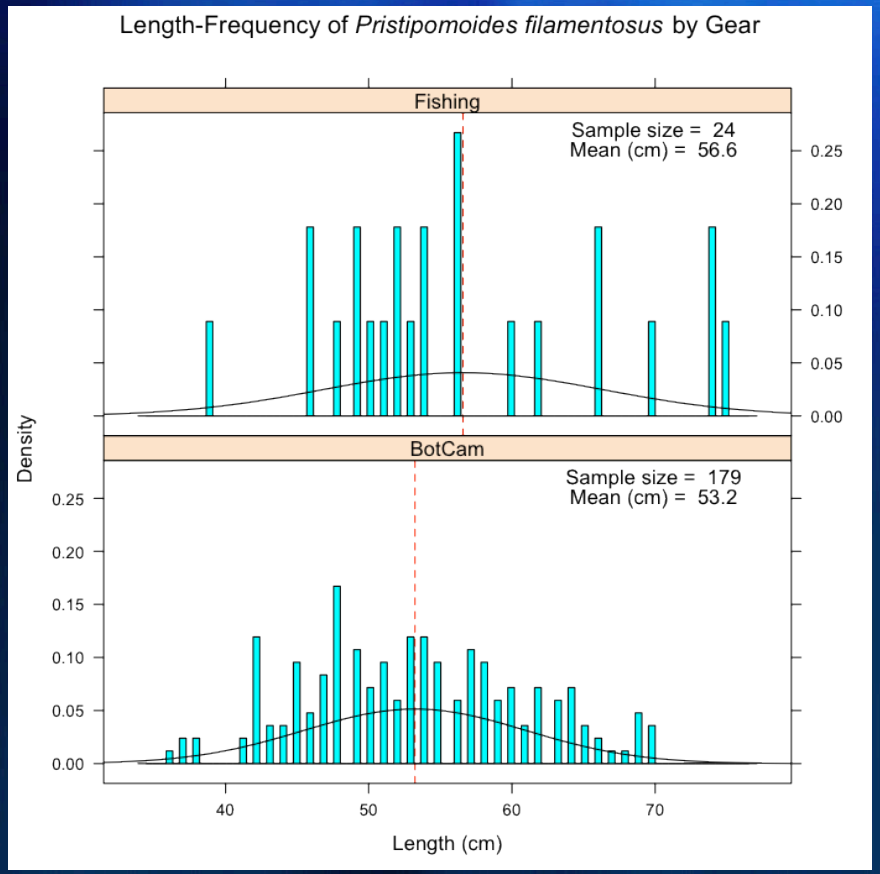
Cooperative Fishing & BotCam

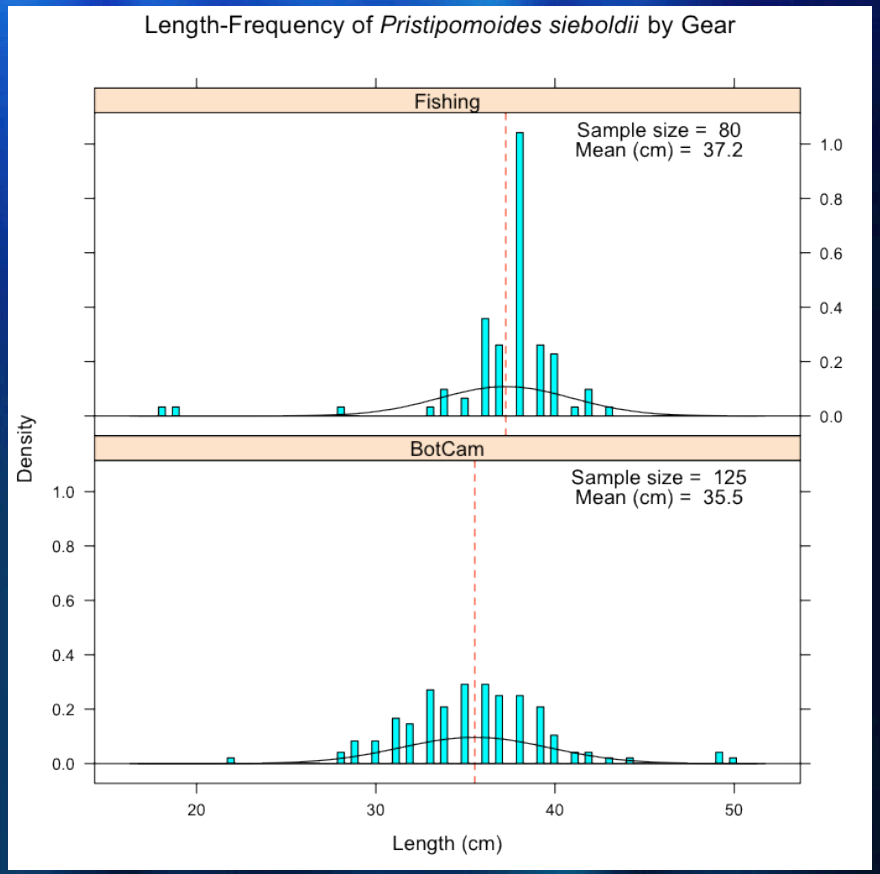




Preliminary Results

Cooperative Fishing & BotCam





Preliminary Results

Cooperative Fishing & BotCam

Mean and difference in fork length (cm) for each Hawaii Deep7 species by sampling method. Data is pooled from SE1102 and SE1208 for Research Fishing and SE1102, SE1107, and SE1208 for BotCam. Significant difference were tested using the Kolmogorov-Smirnov test (D) where 10 or more fish measures were available for each gear or the Wilcoxon test (W) for small sample sizes. Values in bold are significant ($p < 0.05$). –: not tested due to few measurements.

Species	**Research Fishing** Mean ± SE (n)	**BotCam** Mean ± SE (n)	**F-B**	***D***	***W***	**p**
Aphareus rutilans	– (0)	58.8 ± 5.3 (16)	–	–	–	–
Etelis carbunculus	43.0 ± 0.9 (68)	43.7 ± 0.9 (35)	-0.7	*0.20*	–	0.33
Etelis coruscans	50.0 ± 1.4 (30)	46.6 ± 1.5 (20)	+3.4	*0.23*	–	0.53
Hyporthodus quernus	74.0 ± 4.0 (2)	69.8 ± 4.6 (8)	+4.2	–	*12*	0.36
Pristipimoides filamentosus	56.6 ± 2.0 (24)	53.2 ± 0.6 (179)	+3.4	*0.18*	–	0.44
Pristipimoides sieboldii	37.3 ± 0.4 (80)	35.5 ± 0.4 (125)	+1.8	*0.39*	–	**< 0.05**
Pristipimoides zonatus	30.8 ± 4.8 (5)	35.0 ± 4.0 (2)	-4.2	–	*4*	0.85

Transition to Operations

- Final Determination of Gear Types
  - Data quality
  - Cost/Benefit
  - Logistics
- Expanded Survey Domain
  - Main Hawaiian Islands
    - 4 zones
      - Niihau/Kauai, Oahu, Molokai/Maui/ Lanai, Big Island
  - Pacific Island Region
    - Samoa, Guam, Commonwealth of the Northern Mariana Archipelago
- Frequency
  - Biannual (Spring, Fall)
- Resource Needs (4 vessels per zone)
  - Cooperative Research Vessels (16)
  - Stereo Camera Systems (16)
    - MOUSS
  - Portable EK60 System? (16)